

CLAIMS

1. A method for strengthen grain boundaries of a single crystal (SX) or directionally solidified (DS) article (1) made from a Ni based superalloy while the article (1) is in the solid state after casting and containing at least a grain boundary or a casting defect with at least one grain boundary, the method comprising the step of
 - (a) applying a surface diffusion process to a surface of the article (1) component, thereby
 - (b) diffusing grain boundary strengthening elements of one or a combination of boron, hafnium, zirconium along the at least one grain boundary of the article (1) to enrich the at least one grain boundary with said grain boundary strengthening elements without forming precipitates.
2. The method according to claim 1, comprising the step of applying as a surface diffusion process a powder pack process, past/slurry application or any other Chemical Vapor Deposition (CVD) process known from the state of the art.
3. The method according to claim 1 or 2, comprising the step of applying a post-diffusion heat treatment after the surface diffusion process to intensify the diffusion of the strengthening elements along the at least one grain boundary.
4. The method according to any of the claims 1 to 3, comprising the step of removing a layer of enriched material of the strengthening elements on the surface of the article (1) chemically or mechanically after the surface diffusion process or after the post-diffusion heat treatment.
5. The method according to any of the claims 1 to 4, comprising the step of applying the surface diffusion process to the article (1) before, during or after the solution and/or precipitation hardening heat treatments.

6. The method according to any of the claims 1 to 5, comprising the step of covering defect-free surface parts of the article (1) for protecting them from the surface diffusion process.
- 5 7. The method according to any of the claims 1 to 6, comprising the step of cleaning oxides and other undesirable contaminants from the surface of the article (1) before the surface diffusion process.
8. The method according to any of the claims 1 to 7, comprising the step of
10 repairing an article (1) with one or a combination of a recrystallized grain, a spurious grain, a sliver or a freckle as casting defect.
9. The method according to any of the claims 1 to 8, comprising the step of
15 applying the surface diffusion process to at least one grain boundary or a casting defect of a gas turbine component as an article (1).